

T08D01 - Acid-Base Titration Practice

Name KEY

Directions: Show HOW you got the answer not just the answer. Put the data into the formula(s), and then show the answer(s). Write the equation first to determine the ratio needed in the titration.

1. If 20.0 mL of a 3.0 M solution of NaOH is required to neutralize 30.0 mL of an acetic acid solution, what is the molarity of the acetic acid?

$$V_A = 0.020\text{ L}$$

$$M_A = 3.0\text{ M}$$

$$V_B = 0.030\text{ L}$$

$$M_B = x$$

$$M_A V_A = M_B V_B$$

$$(3.0\text{ M})(0.020\text{ L}) = M_B(0.030\text{ L})$$

$$M_B = 2.0\text{ M NaOH}$$

2. What is the molarity of a KOH solution if 40.0 mL is necessary to neutralize 20.0 mL of a 2.0 M hydrochloric acid solution.

$$V_B = 0.040\text{ L}$$

$$M_B = x$$

$$V_A = 0.020\text{ L}$$

$$M_A = 2.0\text{ M}$$

$$M_A V_A = M_B V_B$$

$$(2.0\text{ M})(0.020\text{ L}) = M_B(0.040\text{ L})$$

$$M_B = 1.0\text{ M KOH}$$

3. How many grams of KOH are required to neutralize 200.0 mL of a 4.0 M hydrochloric acid solution?

$$V_A = 0.200\text{ L}$$

$$M_A = 4.0\text{ M}$$

$$M_A = \frac{\text{mol}_A}{L_A} = 4.0\text{ M} = \frac{x\text{ mol}}{0.200\text{ L}}$$

$$x\text{ mol} = 0.8\text{ mol HCl} \Rightarrow 0.8\text{ mol BASE}$$

$$0.8\text{ mol KOH} \times \frac{56.11\text{ g KOH}}{1\text{ mol KOH}} = 44.89\text{ g KOH}$$

4. How many liters of 1.5 M carbonic acid are needed to neutralize completely 120.0 g of NaOH?

$$120\text{ g NaOH} \times \frac{1\text{ mol NaOH}}{40.00\text{ g NaOH}} = 3\text{ mol NaOH} \times \frac{1\text{ mol H}_2\text{CO}_3}{2\text{ mol NaOH}} = 1.5\text{ mol H}_2\text{CO}_3$$

$$\frac{1.5\text{ mol}}{x\text{ L}} = 1.5\text{ M}$$

$$1.0\text{ L H}_2\text{CO}_3$$

5. Complete the following chart:

b/c diprotic

ACID		BASE	
concentration	volume	concentration	volume
0.25 M HCl	30.00 mL	0.30 M NaOH	25.00 mL
0.50 M HNO ₃	30. mL	0.75 M KOH	20.00 mL
0.40 M HCl	35.00 mL	1.00 M LiOH	14. mL

6. In a laboratory experiment involving the neutralization of vinegar (acetic acid solution) using 0.50 M NaOH, the following data were collected:

Trial Number	Volume of Vinegar	Volume of base	$M_A V_A = M_B V_B$
1	10.00 mL	17.59 mL	$M_A = 0.880\text{ M}$
2	15.27 mL	28.39 mL	$M_A = 0.930\text{ M}$
3	20.14 mL	36.58 mL	$M_A = 0.908\text{ M}$

Calculate the molarity of the acidic solution along with its density.

$$\frac{0.880 + 0.930 + 0.908}{3} = 0.906\text{ M HC}_2\text{H}_3\text{O}_2 \Rightarrow \frac{\text{mol}}{\text{L}} \times \frac{60.06\text{ g HC}_2\text{H}_3\text{O}_2}{1\text{ mol HC}_2\text{H}_3\text{O}_2} \times \frac{1\text{ L}}{1000\text{ mL}}$$

$$d_{\text{HC}_2\text{H}_3\text{O}_2} = 0.0544\text{ g/mL}$$